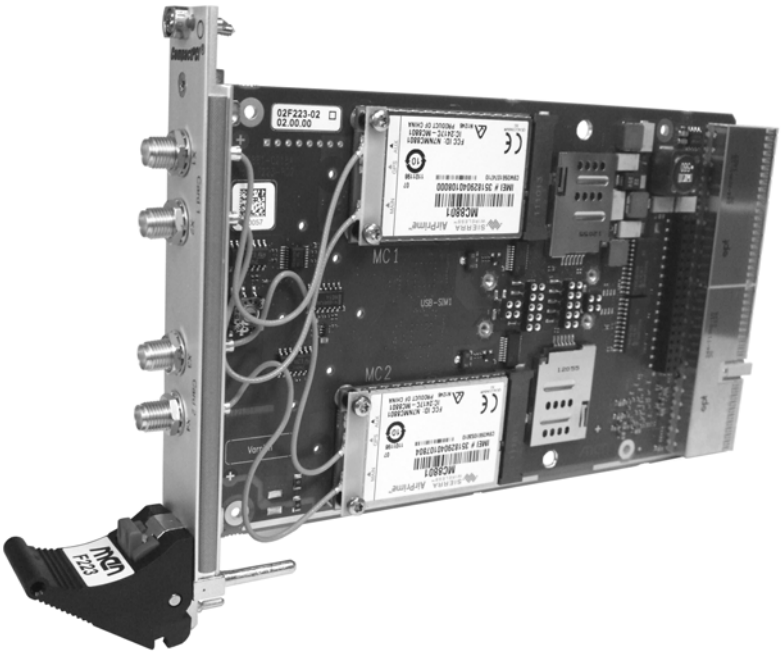
Embedded Solutions

F223 – 3U CompactPCI®
PCIe® Mini Card Carrier



Configuration example (shown with front panel and PCI Express Mini Cards)

User Manual

mikro elektronik
gmbh · nürnberg

F223 - 3U CompactPCI PCIe Mini Card Carrier

The F223 is a rugged single Eurocard CompactPCI carrier board supporting the PCI Express Mini Card standard.

The standard version of the F223 offers two PCI Express Mini Card slots with USB and PCI Express connection. It allows to use all types of cards for wireless applications making it possible to extend the functionality of a CompactPCI system in the same fast and easy way as a common notebook.

Each PCI Express Mini Card is connected to two or three robust redundant external SMA antenna connectors at the front panel of the F223. It is possible to reset and power on and off the two PCI Express Mini Cards separately without having to reset the whole system.

Using a plug-on adapter board as much as eight additional SIM cards per PCI Express card can be implemented. Even with the adapter assembled the board still only needs a width of 4HP. Another option is to equip the board with a USB-SIM emulator for controlling SIM cards on a central server.

The F223 is designed for -40 to +85°C operating temperature using qualified components and conformally coated in order to be used also in harsh and mobile environments. The final environmental qualification depends on the respective cards used on the carrier.

Technical Data

Card Interfaces

- For two PCI Express® Mini Cards
  - With two SIM card holders (one for each PCI Express® Mini Card)
- PCI Express® and USB interface
- Individual reset and power on/off for each PCI Express® Mini Card
  - Via GPIO lines of the PCI Express®/USB controller
- Up to 16 additional SIM cards on a special adapter board
- USB-SIM socket for SIM emulator
- Please note that MEN does not offer SIM cards or mobile telephony contracts!

Front Connections

- Up to six Reverse SMA antenna connectors (front panel available as an accessory)

CompactPCI® Bus

- Compliance with CompactPCI® Core Specification PICMG 2.0 R3.0
- Peripheral slot
- 32-bit/33-MHz PCI-to-PCI Express® bridge
- V(I/O): +3.3V (+5V tolerant)
- J2 connector with geographical addressing for distinguishing boards in a system with several boards

Electrical Specifications

- Supply voltage/power consumption:
  - +5V (-3%/+5%), depending on plugged card, 1.1 A without PCI Express® Mini Cards
  - +3.3V and 1.5V supply voltage for cards generated onboard

Mechanical Specifications

- Dimensions: conforming to CompactPCI® specification for 3U boards
- Front panel: 4HP front panel with four SMA connectors available as an accessory
- Weight:
  - 198 g (with front panel and PCI Express® Mini cards)
  - 104 g (without front panel and PCI Express® Mini cards)

Environmental Specifications

- Temperature range (operation):
  - -40..+85°C (screened, only carrier, depending on configuration)
  - Airflow: min. 1.0 m/s
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to + 3,000 m
- Shock: 50 m/s², 30 ms (EN 61373)
- Vibration (function): 1 m/s², 5 Hz – 150 Hz (EN 61373)
- Vibration (lifetime): 7.9 m/s², 5 Hz – 150 Hz (EN 61373)
- Conformal coating

MTBF

- 1,224,236 h @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- Flammability
  - PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers
- Electrical Safety
  - Insulation measurement test according to EN 50155 (12.2.9.1) (railway)
  - Voltage withstand test according to EN 50155 (12.2.9.2) (railway)
  - Information technology equipment test according to EN 60950 (information technology equipment)
  - Voltage withstand test according to EN 50124-1 (Annex B) (signal- and tele-communication equipment)

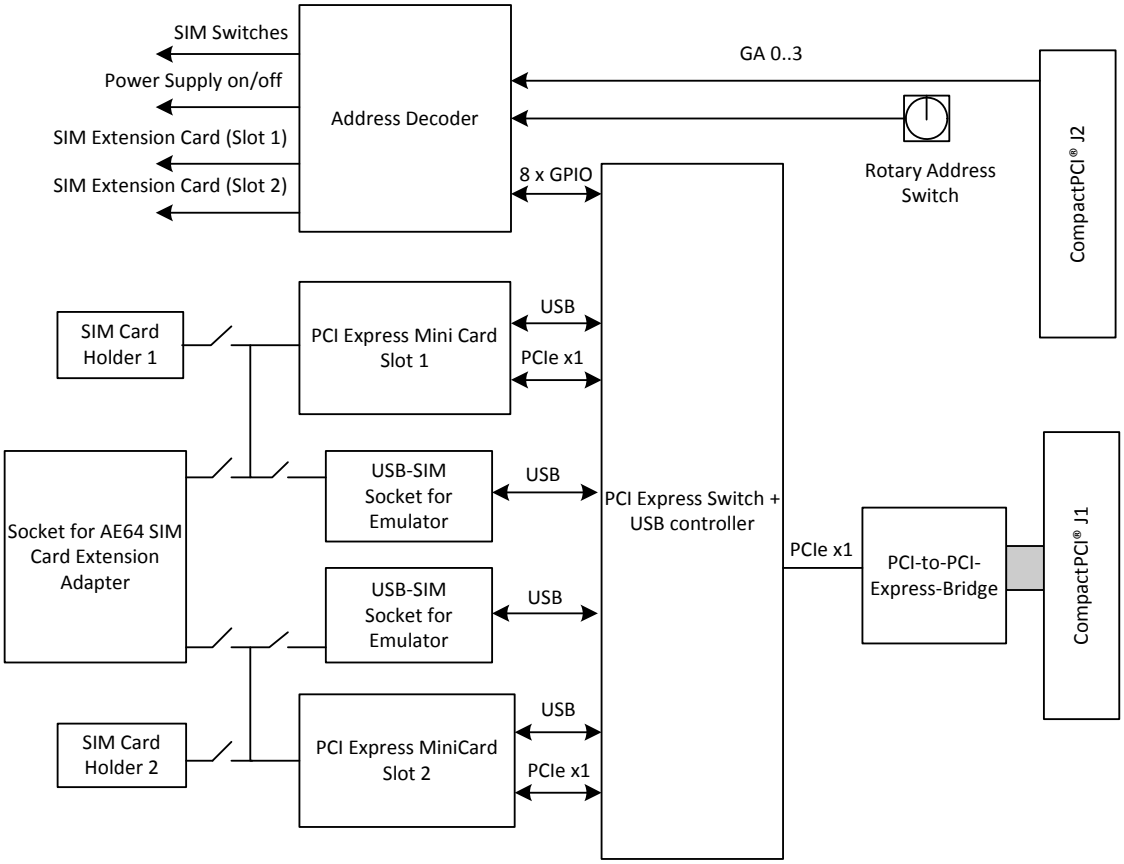
EMC Conformity

- EN 55022 (radio and conducted disturbance)
- IEC 61000-4-2 (ESD)
- IEC 61000-4-3 (electromagnetic field immunity)
- IEC 61000-4-4 (burst)
- IEC 61000-4-5 (surge)
- IEC 61000-4-6 (conducted disturbances)

Software Support

- MEN Driver Interface System (MDIS™ for all supported operating systems)
- For more information on supported operating system versions and drivers see online data sheet.

Block Diagram



Configuration Options

Card Slots

- Up to 22 SIM card holders (eleven for each PCI Express® Mini Card)
- I2S interface for audio signals (via digital audio I/O streamer)
  - I2S interface only with special non-standard PCI Express® Mini Card
- USB-SIM emulator
- For two PCI Express® Full-Mini or Half-Mini Cards (dual-use sockets)

Front Panel

- Two or three antennas per PCI Express® Mini Card
- QMA instead of SMA antenna connectors

Cooling Concept

- Also available with conduction cooling in MEN CCA frame

Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.

For available standard configurations see online data sheet.

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2013-02-06

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This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics — Folder, file and function names are printed in *italics*.

bold — **Bold** type is used for emphasis.

`monospace` — A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

comment — Comments embedded into coding examples are shown in green color.

hyperlink — Hyperlinks are printed in blue color.

The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

IRQ# /IRQ — Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out — Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

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The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

In other words: Since MEN does not deliver ready-made products to end users, the WEEE directive is not applicable for MEN. Users are nevertheless recommended to properly recycle all electronic boards which have passed their life cycle.

Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

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Germany
MEN Mikro Elektronik GmbH
Neuwieder Straße 3-7
90411 Nuremberg
Phone +49-911-99 33 5-0
Fax +49-911-99 33 5-901
E-mail info@men.de
www.men.de

France
MEN Mikro Elektronik SA
18, rue René Cassin
ZA de la Châtelaine
74240 Gaillard
Phone +33 (0) 450-955-312
Fax +33 (0) 450-955-211
E-mail info@men-france.fr
www.men-france.fr

USA
MEN Micro, Inc.
24 North Main Street
Ambler, PA 19002
Phone (215) 542-9575
Fax (215) 542-9577
E-mail sales@menmicro.com
www.menmicro.com

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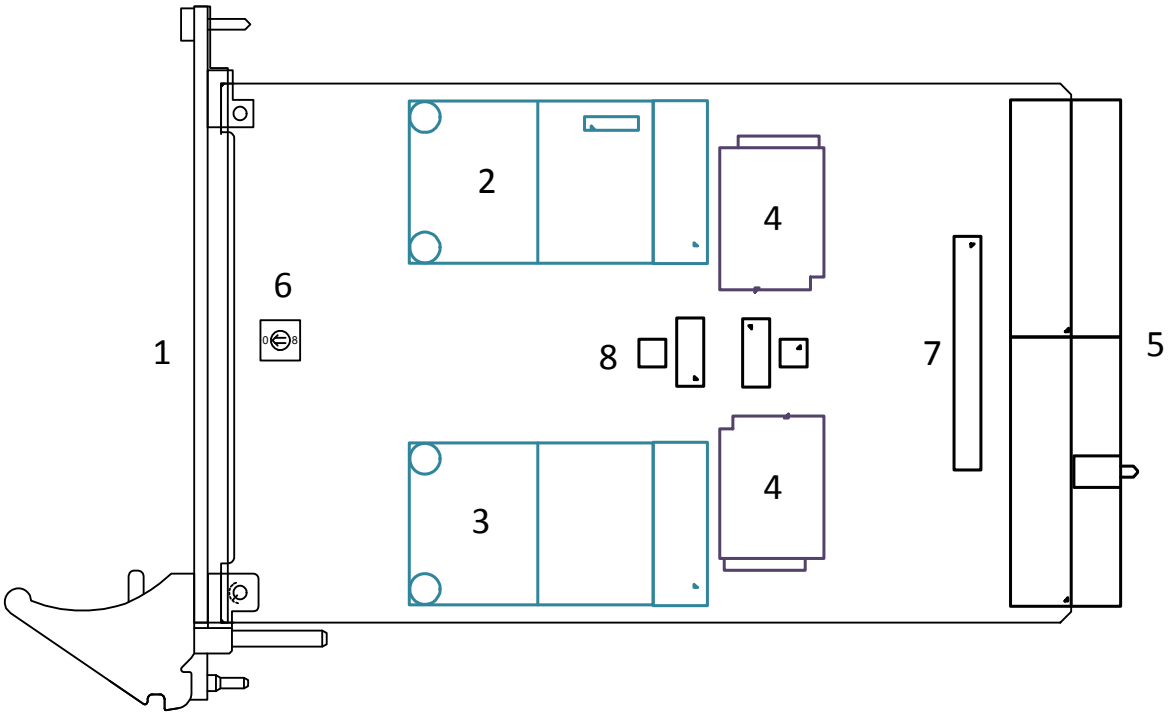
1 Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

1.1 Map of the Board

Figure 1. *Map of the board – top view*

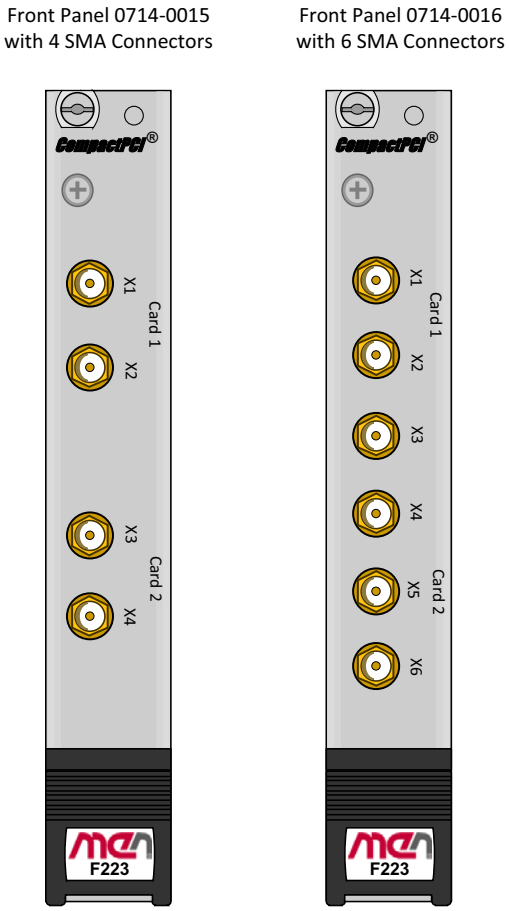


1 Variable Front Panel (e.g. with 4 or 6 SMA antenna connectors)
2 PCI Express Mini Card 1
3 PCI Express Mini Card 2
4 SIM Card Sockets
5 CompactPCI Connectors
6 Rotary Switch
7 Connector for SIM card adapter
8 Connectors for SIM Emulators

1.2 Front Panel

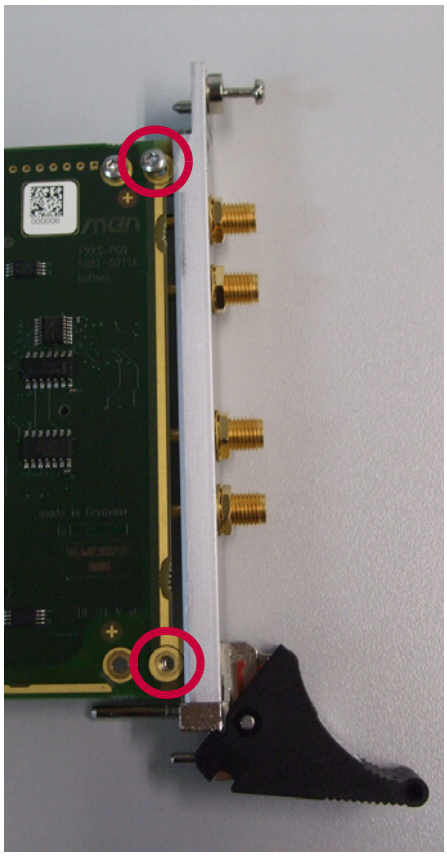
The standard version of the F223 is delivered without front panel. Two different front panels, with 4 or 6 SMA antenna connectors respectively, can be ordered on MEN's website.

Figure 2. *Possible front panels*



1.2.1 Installing a Front Panel

The front panel is installed on the F223 using two screws as shown in the following picture:



The screws are included in the delivery.

1.3 Integrating the Board into a System

You can use the following check list when installing the board in a system for the first time and with minimum configuration.

- ☑ Power down the system.
- ☑ Install one or two PCI Express Mini Cards on the F223 as described in Chapter 2.2.1 Installing a PCI Express Mini Card on page 20.
- ☑ If you want to use more than one SIM card install the SIM Extension Adapter. See Chapter 2.4.1 Installing the AE64 Adapter Board on page 24.
- ☑ Insert the F223 into a peripheral slot of your CompactPCI system, making sure that the CompactPCI connectors are properly aligned.

  Note: The peripheral slots of every CompactPCI system are marked by a circle ○ on the backplane and/or at the front panel.
- ☑ Power up the system.
- ☑ You can now install driver software.

1.4 Installing Driver Software

MEN offers a low-level driver for controlling the eight GPIO lines from the PCI Express switch. These GPIOs are used to switch on and off and reset the PCI Express Mini Cards (dependent on the PCI Express Mini Card used) as well as switch the SIM cards on the AE64 SIM card extension adapter. See Chapter Example: on page 29.

You can find any driver software available for download in the F223 pages on MEN's website.

In addition you need the driver for the PCI Express Mini Card that you are using.

Make sure you are using the latest firmware and software driver version of your MiniPCIe Card.

For a detailed description on how to install driver software please refer to the respective documentation.

2 Functional Description

2.1 Power Supply

The board is supplied with +5V via CompactPCI connector J1.

2.2 PCI Express Mini Card Interface

The F223 supports the PCI Express Mini Card standard. As an option, it also supports PCI Express Half-Mini Cards.

Please check whether the PCI Express Mini Card that you are using complies to the PCI Express Mini Card standard. There can be problems if a non-compliant PCI Express Mini Card is used on the F223.

PCI Express Mini Cards use either a single PCI Express lane (x1) or a USB connection. The card is connected to the CompactPCI bus via a PCI-to-PCI-Express-bridge and a PCI Express-to-USB swidge (switch and bridge in one chip).

The board is equipped with two 52-pin standard PCI Express Mini Card connectors. The following standard signals are supported:

Table 1. *Pin assignment of 52-pin PCI Express Mini Card connector*

Pin	Signal	Function
1	WAKE#	not connected
2	+3.3Vaux	Power
3	COEX1	not connected
4	GND	Power
5	COEX2	not connected
6	1.5V	Power
7	CLKREQ#	Reference clock request signal
8	UIM_PWR	SIM card power
9	GND	Power
10	UIM_DATA	SIM card data
11	REFCLK-	PCI Express differential reference clock (100 MHz)
12	UIM_CLK	SIM card clock
13	REFCLK+	PCI Express differential reference clock (100 MHz)
14	UIM_RESET	SIM card reset
15	GND	Power
16	UIM_VPP	not connected
17	UIM_IC_DM	not connected
18	GND	Power
19	UIM_IC_DP	not connected

Pin	Signal	Function
20	W_DISABLE#	Disable radio operation
21	GND	Power
22	PERST#	Reset to the Mini Card
23	PERn0	PCI Express receive line
24	+3.3Vaux	Power
25	PERp0	PCI Express receive line
26	GND	Power
27	GND	Power
28	+1.5V	Power
29	GND	Power
30	SMB_CLK	System management bus clock
31	PETn0	PCI Express transmit line
32	SMB_DATA	System management bus data
33	PETp0	PCI Express transmit line
34	GND	Power
35	GND	Power
36	USB_D-	USB line
37	GND	Power
38	USB_D+	USB line
39	+3.3Vaux	Power
40	GND	Power
41	+3.3Vaux	Power
42	LED_WWAN#	not connected
43	GND	Power
44	LED_WLAN#	not connected
45	Reserved	
46	LED_WPAN#	not connected
47	Reserved	
48	+1.5V	Power
49	Reserved	
50	GND	Power
51	W_DISABLE2#	Disable radio operation 2
52	+3.3Vaux	Power

Please refer to the PCI Express Mini Card Specification for further details. See Chapter 3.2 Literature and Web Resources on page 35.

2.2.1 Installing a PCI Express Mini Card

Perform the following steps to install a PCI Express Mini Card. The required screws and washers are included in the delivery. Models with the optional PCI Express Half-Mini Card support offer a separate pair of nuts for the smaller modules.

- ☑ Insert the PCI Express Mini Card into the card connector in a 30° angle.
- ☑ Put the washers included in the delivery between the F223 and the PCI Express Mini Card.
- ☑ Rotate the card down until it sits firmly in the connector.
- ☑ Screw the PCI Express Mini Card tightly to the F223. See Figure 3, Installing a PCI Express Mini Card - standard F223 model.
- ☑ Connect the antennas to the PCI Express Mini Card.

Figure 3. *Installing a PCI Express Mini Card - standard F223 model*

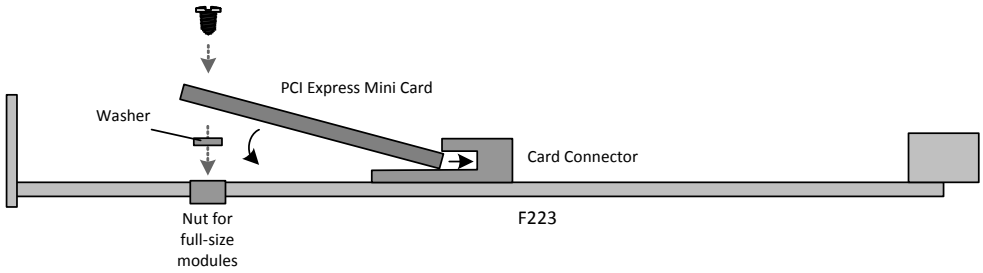
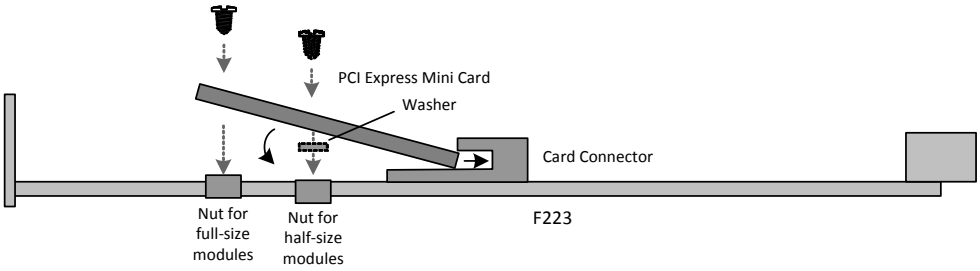


Figure 4. *Installing a PCI Express Mini Card - with optional Half-Mini Card nuts*



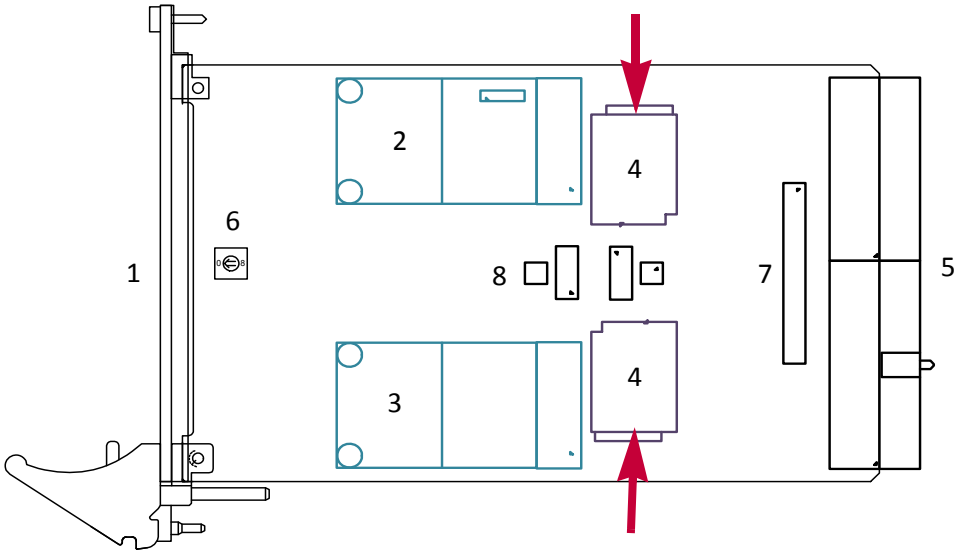
2.3 SIM Card Holders

The standard model of the F223 is equipped with two SIM card holders directly on the board.

To get access to a mobile phone network you need a SIM card (subscriber identity module) and a contract with a mobile service provider. **Please note that MEN does not provide mobile services or SIM cards!**

Insert the SIM cards as indicated by the red arrows in Figure 5, SIM card holders.

Figure 5. *SIM card holders*



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2 PCI Express Mini Card 1
3 PCI Express Mini Card 2
4 SIM Card Sockets
5 CompactPCI Connectors
6 Rotary Switch
7 Connector for SIM card adapter
8 Connectors for SIM Emulators

2.4 AE64 SIM Extension Adapter

The F223 offers the possibility to extend the number of SIM cards by 16 using a plug-on adapter board, the AE64.

The adapter can be plugged onto the F223 via a 34-pin board-to-board connector and is available as an accessory. For ordering information please see MEN's website.

For mechanical reasons, only 16 of the 20 SIM card slots on the standard AE64 (article number 08AE64-00) are accessible. If you need the complete number of 20 SIM card slots please contact MEN's sales team.

10 of the SIM card slots are available on the top of the adapter board and 6 on the bottom (see Figure 6, AE64 Adapter (bottom side with reduced number of SIM cards).

Figure 6. *AE64 Adapter (bottom side with reduced number of SIM cards)*

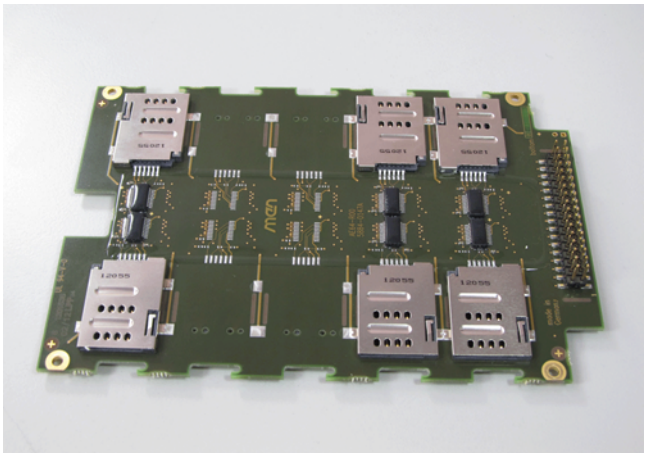
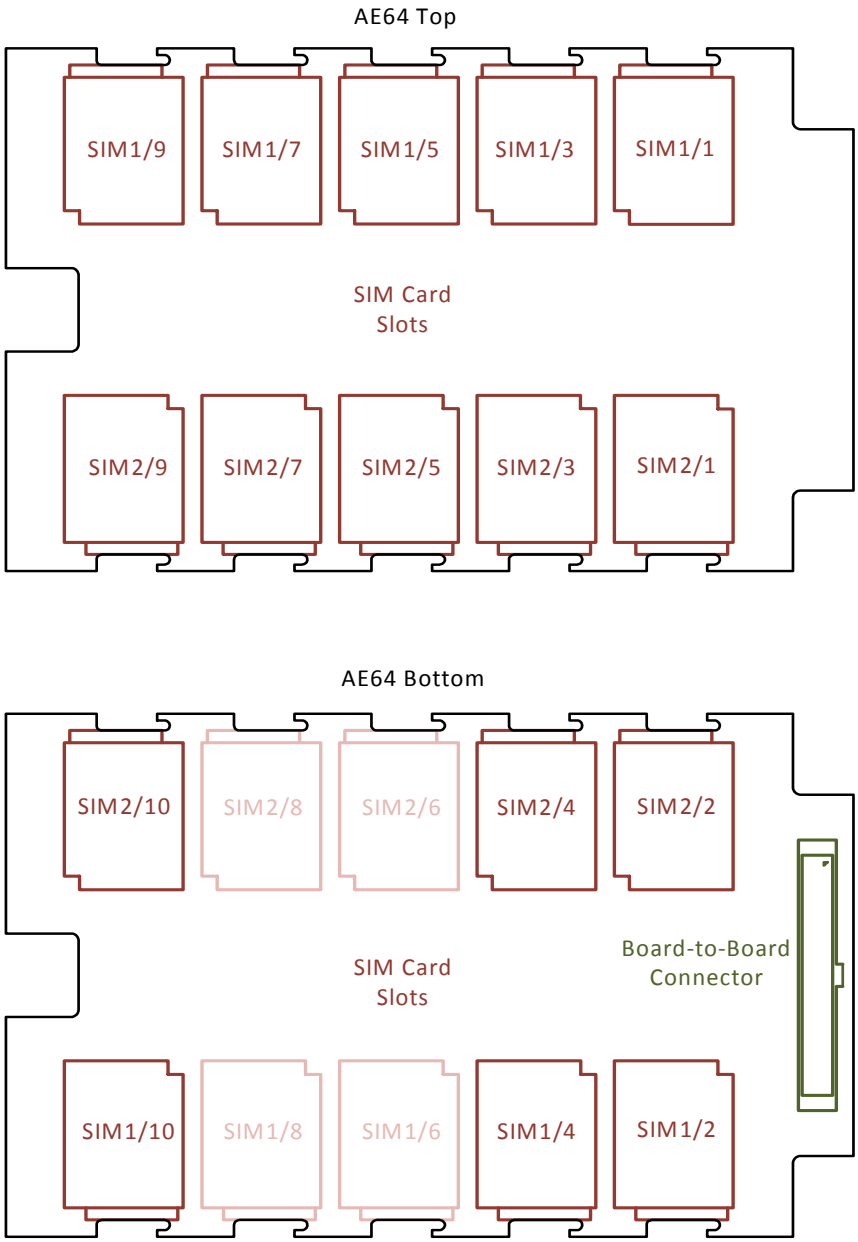


Figure 7. *AE64 board map with SIM card numbering*



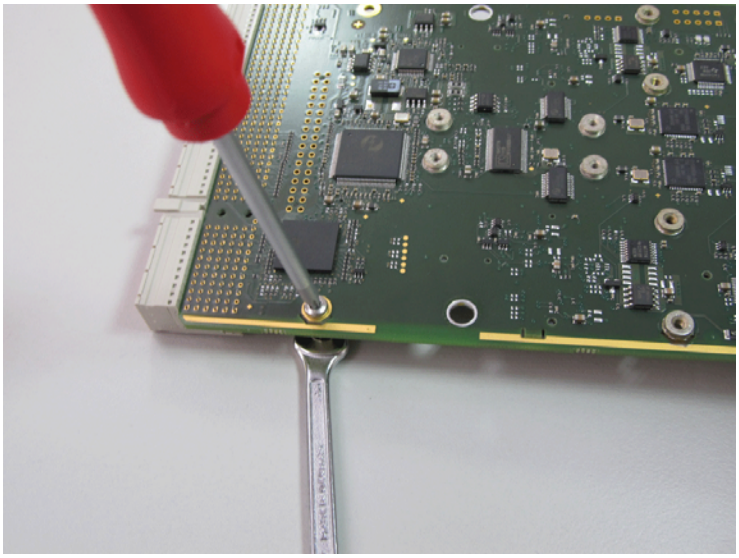
The SIM cards marked in light red are not assembled on the standard version

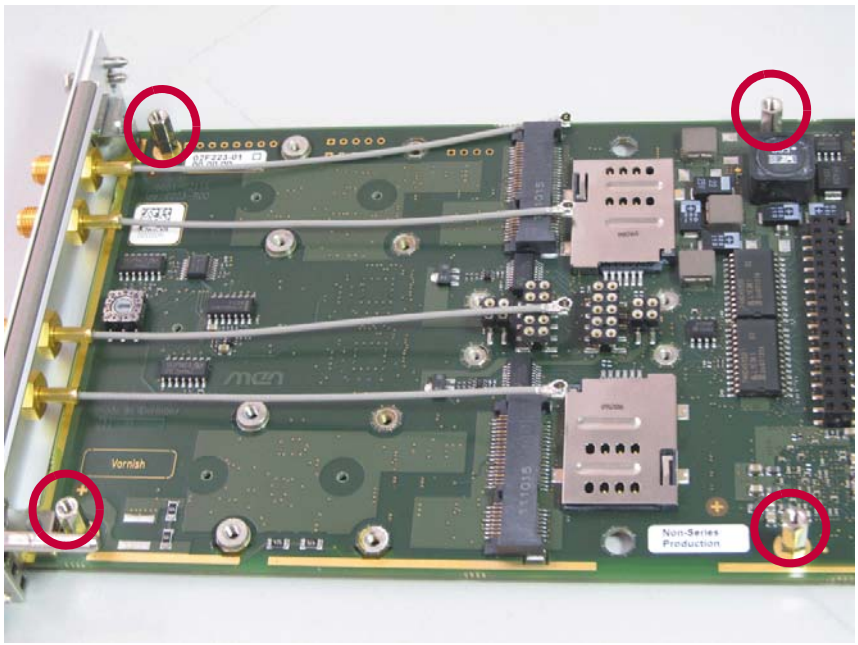
2.4.1 Installing the AE64 Adapter Board

The mounting material required for installing the AE64 adapter board on the F223 is included in the delivery of the AE64. It consists of eight M2,5x6 TX8 pan-head screws and four M2,5x10 standoffs.

Carry out the following steps to install the AE64:

☑ Screw the standoffs onto the F223 using the first four screws. The screws are fastened on the bottom of the board.



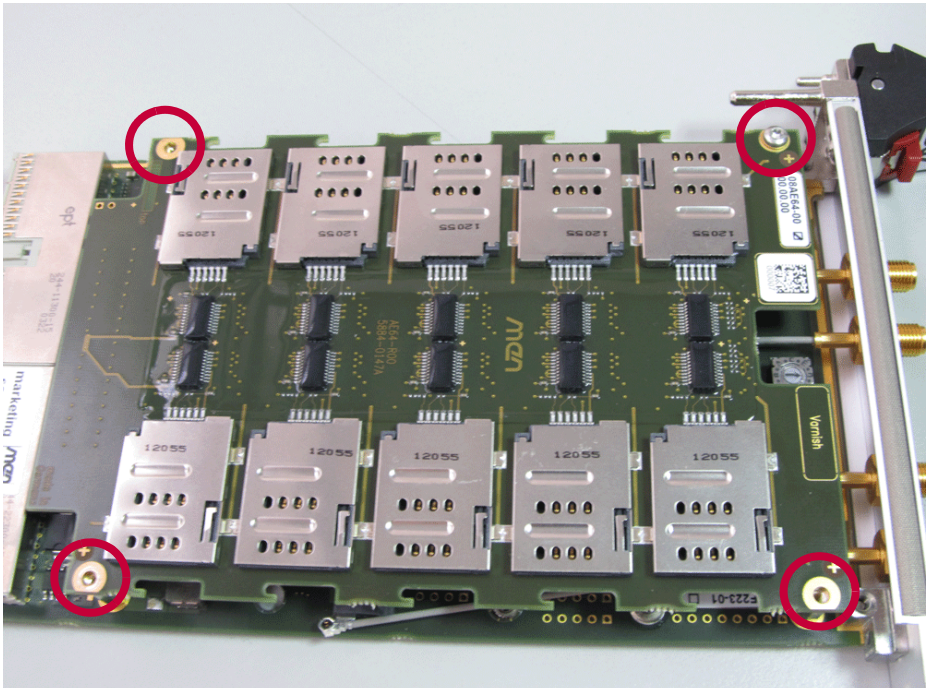


☑ If you have not done so already, install the PCI Express Mini cards. See Chapter 2.2.1 Installing a PCI Express Mini Card on page 20.

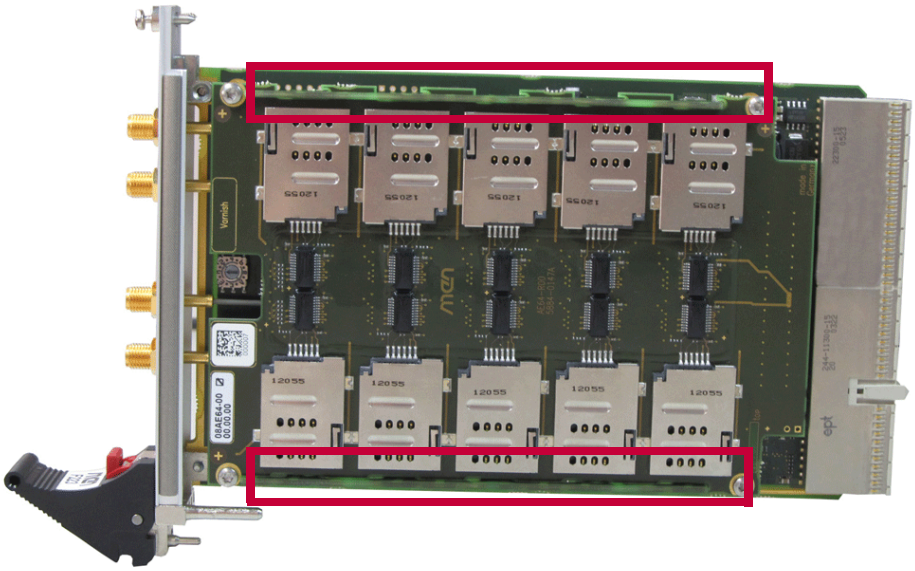
☑ Carefully align the board-to-board connectors and plug the AE64 onto the F223.

☑ Press the AE64 firmly onto the F223.

☑ Fasten the four screws on top of the AE64.



☑ Take care that the green SIM card protection (marked in red in the following picture) is at the right position at the sides of the AE64.



2.5 USB/SIM Socket for Emulator

The F223 also provides the option to use two SIM emulators – one for each PCI Express Mini Card. They can be plugged onto two connectors respectively.

The AE64 SIM card extension adapter cannot be used in that case.

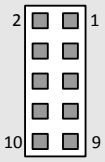
Two SIM/USB sockets are assembled on the F223 for each PCI Express MiniCard. The sockets provide 1 USB 1.1 interface, the SIM interface and the power supply.

The power supply for the SIM emulators is activated using GPIO lines 2 and 3.

Table 2. *Pin assignment of 4-pin SIM emulator interface connectors*

	2	USB_SIM1/2_p	1	GND
	4	USB_SIM1/2_n	3	SW_POW_USA1/2

Table 3. *Pin assignment of 10-pin SIM emulator interface connectors*

	2	USA1/2_SW	1	CLK_USA1/2
	4	USA1/2_SWR	3	PWR_USA1/2
	6	-	5	GND
	8	-	7	RST_USA1/2
	10	-	9	DATA_USA1/2

2.6 CompactPCI Interface

The F223 supports a 32-bit 33-MHz CompactPCI interface fully compatible with CompactPCI specification PICMG 2.0 Rev. 3.0. The board works with 3.3V and tolerates 5V V I/O.

For full CompactPCI functionality only the J1 connector is needed, therefore the board only has a J1 connector to the bus.

Connector type of J1:

- 110-pin shielded, 2mm-pitch, 5-row receptacle according to IEC 917 and IEC 1076-4-101

The pin assignment of connector J1 as defined in the CompactPCI specification will not be repeated here.

2.6.1 Geographical Addressing

The F223 also provides CompactPCI J2 connector for geographical addressing. It provides the GA signals GA0 to GA3.

If the rotary switch is set to 0, then the GA address is read by the GPIOs of the PCI Express switch at startup of the board, otherwise the GPIOs read the data of the rotary switch. See Chapter Example: on page 29 for more information about the GPIOs.

If CompactPCI connector J2 is not assembled, the GA address of the CompactPCI slot can be set using the rotary switch. See Chapter Figure 1. Map of the board – top view (Number 5).

2.7 Switching and Reset via GPIO

The F223 offers the possibility to reset and switch on and off each PCI Express Mini Card individually as well as switch between the different SIM cards on the AE64 extension adapter. This is done using eight GPIO lines from the PCI Express package switch chip.

MEN offers a low-level software driver for accessing the GPIO lines. For detailed information on how to switch the GPIOs see the following table as well as:

- Chapter 2.7.1 Standard Setting of the F223 on page 29,
- Chapter 2.7.2 Using and Selecting SIM Cards on page 30
- Chapter 2.7.3 Powercycling the PCI Express Mini Cards on page 32 and
- Chapter 2.7.4 Resetting the PCI Express Mini Cards on page 33.

Table 4. *GPIO functions*

GPIO Number	Function
GPIO0	0 = the GPIO lines are set as inputs for reading the geographical address (see Chapter 2.6.1 Geographical Addressing on page 27), only after system start 1 = the GPIO lines are set as outputs for PCI Express Mini Card power and reset and SIM card switching
GPIO1	0 = Enables the soft-reset for the PCI Express Mini Cards and the USB-SIM devices. The device to be reset is then selected by GPIOs 4 to 7 1 = Disables the reset functionality
GPIO2	0 = Switches **on** PCI Express Mini Card 1 1 = Switches **off** PCI Express Mini Card 1 and activates the setting of SIM Bank 1 (SIM cards for PCI Express Mini Card 1) set by GPIOs 4 to 7
GPIO3	0 = Switches on PCI Express Mini Card 2 1 = Switches **off** PCI Express Mini Card 1 and activates the setting of SIM Bank 2 (SIM cards for PCI Express Mini Card 2) set by GPIOs 4 to 7
GPIO4 to 7	Select the SIM card holder for the PCI Express Mini Cards and are responsible for soft-reset functionality

2.7.1 Standard Setting of the F223

For switching off the PCI Express Mini Cards, selecting the SIM card on the F223 and switching the Mini Cards on again the following settings are required:

Table 5. *Standard setting for the F223 board*

Function	GPIO7	GPIO6	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
Switching off the PCI Express Mini Cards	?[1]	?	?	?	HIGH	HIGH	HIGH	HIGH
Selecting the SIM card on the F223 board[2]	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH
Switching on the PCI Express Mini Cards	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH

[1] Random former setting
[2] See Table 6, SIM card selection on page 30 for more information

Note: The GPIOs marked in gray are not touched in the corresponding step.

Example:

When using MEN's MDIS5 *pi7c9_gpio_simp* software tool the following steps are required (-s=1 sets a GPIO port to HIGH, -s=0 sets a GPIO port to LOW):

Step 1: Switching off PCI Express Mini Cards

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=1 -p=0f
(0x0f corresponds to 0000 1111)
```

2. Step: Selecting the SIM cards on the F223

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=f0
(0xf0 corresponds to 1111 0000)
```

3. Step: Switching on the PCI Express Mini Cards again

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=0c
(0x0c corresponds to 0000 1100)
```

2.7.2 Using and Selecting SIM Cards

The following table lists the GPIOs you have to write for switching the different SIM cards. For this, all 8 GPIO ports are necessary.

GPIO 0 and 1 always have to be HIGH. By writing GPIO 4, 5, 6 and 7, a SIM card will be selected and with a short state change of the GPIO 2 (for Mini Card 1) and/or 3 (for Mini Card 2) you can realize a powercycle to reset the Mini Cards and validate the selected SIM card change (see chapter Chapter 2.7.3 Powercycling the PCI Express Mini Cards).

Table 6. *SIM card selection*

Function	GPIO7	GPIO6	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
SIM1/0 or SIM2/0 (SIM cards on F223)	LOW	LOW	LOW	LOW	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/1 or SIM2/1	LOW	LOW	LOW	HIGH	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/2 or SIM2/2	LOW	LOW	HIGH	LOW	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/3 or SIM2/3	LOW	LOW	HIGH	HIGH	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/4 or SIM2/4	LOW	HIGH	LOW	LOW	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/5 or SIM2/5	LOW	HIGH	LOW	HIGH	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/6 or SIM2/6	LOW	HIGH	HIGH	LOW	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/7 or SIM2/7	LOW	HIGH	HIGH	HIGH	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/8 or SIM2/8	HIGH	LOW	LOW	LOW	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/9 or SIM2/9	HIGH	LOW	LOW	HIGH	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
SIM1/10 or SIM2/10	HIGH	LOW	HIGH	LOW	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH
USB_SIM1 or 2 on emulator socket	HIGH	LOW	HIGH	HIGH	HIGH/ LOW[2]	HIGH/ LOW[1]	HIGH	HIGH

1 HIGH-LOW change to powercycle Mini Card 1 and peripherals
2 HIGH-LOW change to powercycle Mini Card 2 and peripherals

Example:

To set SIM card 5 for PCI Express Mini Card 1 (SIM1/5) you have to write GPIO 0, 1, 4, 6 to HIGH (Step 1) and GPIO 5 and 7 to LOW (Step 2). To reinitialize the modem a powercycle at Mini Card 1 has to be done by setting GPIO 2 (Step 3 and 4). For setting SIM card 5 at Bank 2 (SIM2/5) GPIO 3 has to be toggled.

When using MEN's MDIS5 *pi7c9_gpio_simp* software tool the following steps are required (-s=1 sets a GPIO port to HIGH, -s=0 sets a GPIO port to LOW):

Step 1: Setting GPIO 0,1,4,6 to HIGH

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=1 -p=53
(0x53 corresponds to binary value 0101 0011)
```

Step 2: Setting GPIO 5 and 7 to LOW

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=A0
(0xA0 corresponds to binary value 1010 0000)
```

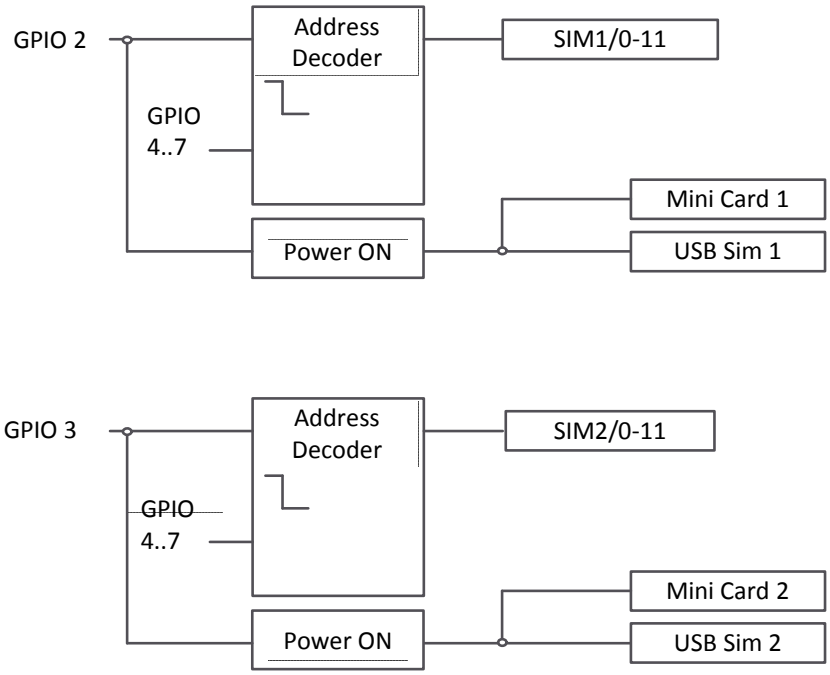
Step 3: Switching PCI Express Mini Card off by setting GPIO 2 to HIGH

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=1 -p=04
(0x04 corresponds to binary value 0000 0100)
```

Step 4: Switching PCI Express Mini Card on by setting GPIO 2 to LOW

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=04
(0x04 corresponds to binary value 0000 0100)
```

Figure 8. *SIM card switching*



2.7.3 Powercycling the PCI Express Mini Cards

The F223 offers the possibility to switch on and off each PCI Express Mini Card and the corresponding USB-SIM emulator socket and optional audio device (only on special board versions). For this, only the GPIO 0, 1, 2 and 3 are necessary. The GPIO 0 and 1 must always be HIGH and with writing GPIO 2 and/or 3 to HIGH the Mini Card 1 and/or 2 are powered off. By writing GPIO 2 and/or 3 to LOW the Mini Card 1 and/or 2 are powered on. With a short state change of the GPIO 2 and 3 you can realize a powercycle.

Table 7. *Settings for PCI Express Mini Card powercycling*

Function	GPIO7	GPIO6	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
PCI Express Mini Card 1	HIGH	HIGH	LOW	LOW	LOW	HIGH/ LOW[1]	HIGH	HIGH
PCI Express Mini Card 2	HIGH	HIGH	LOW	HIGH	HIGH/ LOW[2]	LOW	HIGH	HIGH

1 HIGH-LOW change to powercycle Mini Card 1 and peripherals
2 HIGH-LOW change to powercycle Mini Card 2 and peripherals

Example:

To switch off the PCI Express Mini Card 1 and the corresponding USB-SIM emulator socket (or optional audio device) you have to set GPIO 0, 1 and 2 to HIGH. To switch the devices on only switch the GPIO 2 to LOW again.

To switch off the PCI Express Mini Card 2 and the corresponding USB-SIM emulator socket (or optional audio device) you have to set GPIO 0, 1 and 3 to HIGH. To switch the devices on only switch the GPIO 3 to LOW again.

When using MEN's MDIS5 *pi7c9_gpio_simp* software tool the following settings are required (-s=1 sets a GPIO port to HIGH, -s=0 sets a GPIO port to LOW):

Power-cycling PCI Express Mini Card 1 and USB-SIM emulator socket 1:

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=1 -p=07
(0x07 corresponds to 0000 0111)
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=04
(0x04 corresponds to 0000 0100)
```

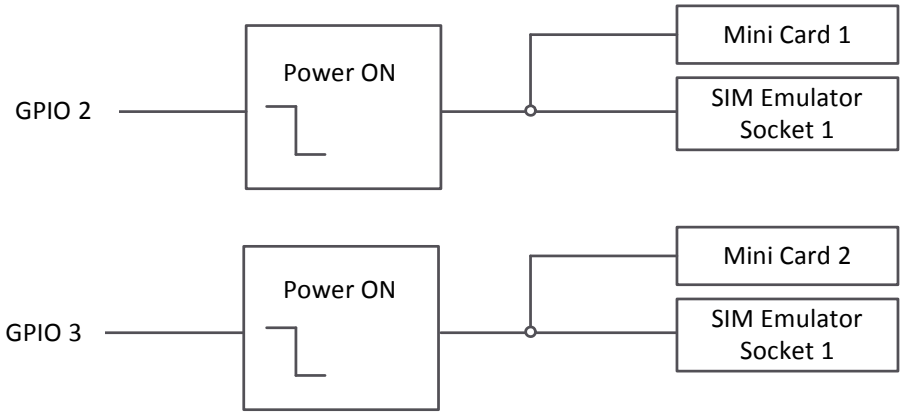
Power-cycling PCI Express Mini Card 2 and USB-SIM emulator socket 2:

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=1 -p=0a
(0x0a corresponds to 0000 1010)
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=08
(0x08 corresponds to 0000 1000)
```

Power-cycling PCI Express Mini Card 1 and 2 and USB-SIM emulator socket 1 and 2 simultaneously:

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=1 -p=0f
(0x0f corresponds to 0000 1111)
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=0c
(0x0c corresponds to 0000 1100)
```

Figure 9. *Powercycling the PCI Express Mini Cards*



2.7.4 Resetting the PCI Express Mini Cards

The following table lists the GPIOs you have to set to perform different device resets. For this, GPIOs 4, 5, 6 and 7 are necessary to select the device to reset. The GPIO 0 must always be HIGH and with toggeling GPIO 1 to HIGH and return to LOW the reset of the selected device is initiated.

Table 8. *Resetting the PCI Express Mini Cards and the USB-SIM emulator socket*

Function	GPIO7	GPIO6	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
Reset PCI Express Mini Card 1	HIGH	HIGH	HIGH	HIGH	LOW	LOW	LOW/ HIGH[1]	HIGH
Reset PCI Express Mini Card 2	LOW	HIGH	HIGH	HIGH	LOW	LOW	LOW/ HIGH[1]	HIGH
Reset USB-SIM1 (socket for SIM emulator)	HIGH	LOW	HIGH	HIGH	LOW	LOW	LOW/ HIGH[1]	HIGH
Reset USB-SIM2 (socket for SIM emulator)	LOW	LOW	HIGH	HIGH	LOW	LOW	LOW/ HIGH[1]	HIGH

1 LOW = reset / HIGH = normal (no reset)

Example:

To turn off the USB-SIM1 emulator socket/Audio1 you have to write GPIO 0, 4, 5 and 7 to HIGH and GPIO 1, 2, 3 and 6 to LOW. To turn on the devices write only GPIO 1 back to HIGH.

When using MEN's MDIS5 *pi7c9_gpio_simp* software tool the following steps are required (-s=1 sets a GPIO port to HIGH, -s=0 sets a GPIO port to LOW)

Step 1: Setting GPIO 0, 4, 5 and 7 to HIGH

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=1 -p=b1
(0xb1 corresponds to 1011 0001)
```

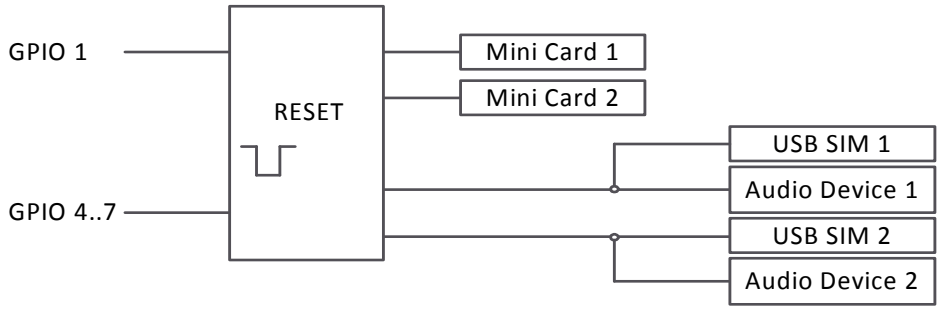
Step 2: Setting GPIO 1, 2, 3 and 6 to LOW

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=4e
(0x4e corresponds to 0100 1110)
```

Step 3: Setting GPIO 1 to HIGH to switch device back on

```
root@men-F19P:/# pi7c9_gpio_simp pi7c9_gpio_1 -s=0 -p=02
(0x02 corresponds to 0000 0010)
```

Figure 10. *Resetting the PCI Express Mini Cards*



3 Appendix

3.1 PCI Configuration

The F223 has the following IDs on the PCI bus:

- PCI Device ID: 0xE110 (PCIe to PCI bridge)
- PCI Vendor ID: 0x12D8 (Pericom)
- PCI Device ID: 0x400A (PCIe to USB swidge)
- PCI Vendor ID: 0x12D8 (Pericom)
- Subsystem Device ID: 0x400E (OHCI, Func 0/Func 1)
- Subsystem Device ID: 0x400F (EHCI, Func 2)
- Subsystem Vendor ID: 12D8 (Pericom)

3.2 Literature and Web Resources

- F223 data sheet with up-to-date information and documentation:
  www.men.de/products/02F212-.html

3.2.1 CompactPCI

- CompactPCI Specification PICMG 2.0 R3.0:
  1999; PCI Industrial Computers Manufacturers Group (PICMG)
  www.picmg.org
- PCI Local Bus Specification Revision 2.2:
  1995; PCI Special Interest Group
  P.O. Box 14070
  Portland, OR 97214, USA
  www.pcisig.com

3.2.2 PCI Express Mini Card

- PCI Express Mini Card Electromechanical Specification
  Revision 1.2; October 26, 2007
  PCI Special Interest Group
  www.pcisig.com

3.3 Finding out the Product's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or design revisions of the F223. You can find information on the article number, the design revision and the serial number on two labels attached to the board.

- **Article number:** Gives the product's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the design revision of the product.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 11. *Labels giving the board's article number, revision and serial number*